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CANADIANA

AUG 27 1991

GRADE 12 DIPLOMA EXAMINATION

Mathematics 30

June 1991

Alberta
EDUCATION

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**GRADE 12 DIPLOMA EXAMINATION
MATHEMATICS 30**

DESCRIPTION

Time: 2½ hours

Total possible marks: 65

This is a **closed-book** examination consisting of **three** parts:

PART A has 40 multiple-choice questions each with a value of one mark.

PART B has 12 numerical-response questions each with a value of one mark.

PART C has three written-response questions for a total of 13 marks.

A tear-out formula and z-score page is included in this booklet.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

GENERAL INSTRUCTIONS

Fill in the information required on the answer sheet and the examination booklet as directed by the examiner.

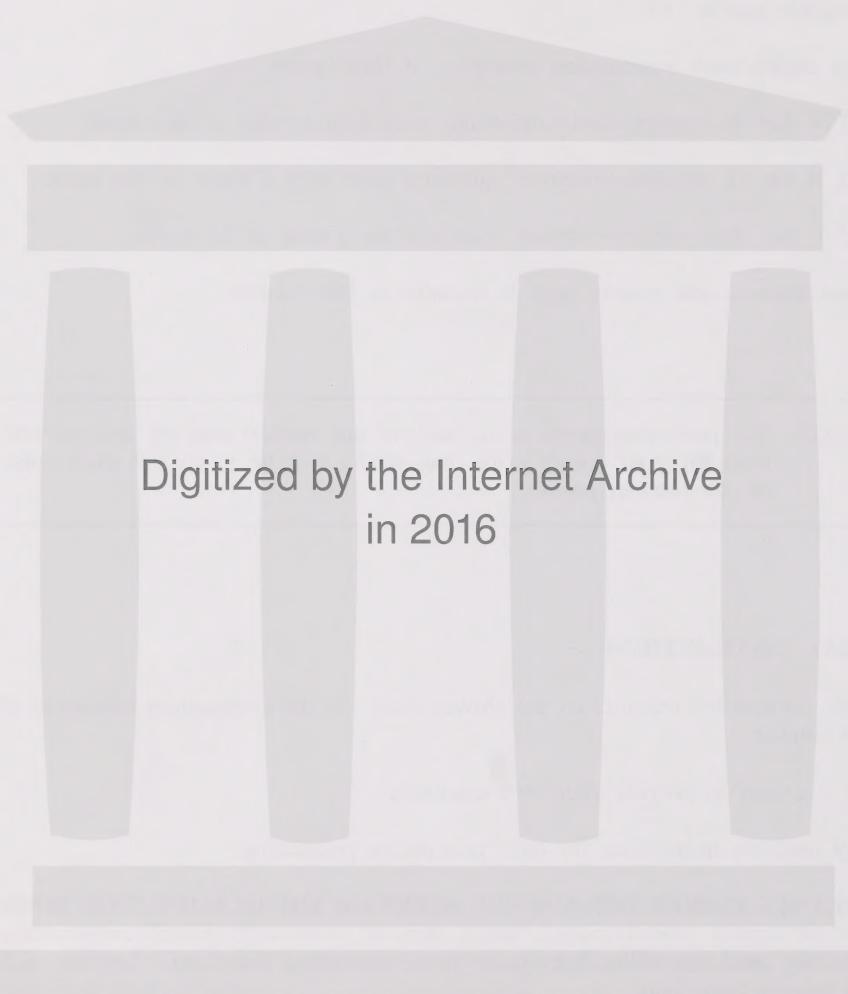
You are expected to provide your own calculator.

Carefully read the instructions for each part before proceeding.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET.

The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Education.

JUNE 1991



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PART A

INSTRUCTIONS

In this part of the examination, there are 40 multiple-choice questions each with a value of one mark. All numbers used in the questions are to be considered as **exact** numbers and are not the result of a measurement.

Read each question carefully and decide which of the choices **best** completes the statement or answers the question. Locate that question number on the separate answer sheet provided and fill in the space that corresponds to your choice. **Use an HB pencil only.**

Example

This diploma examination is for the subject of

- A. Biology
- B. Physics
- C. Chemistry
- D. Mathematics

Answer Sheet

A B C D

① ② ③ ●

If you wish to change an answer, erase your first mark completely.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

**DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL
TOLD TO DO SO BY THE PRESIDING EXAMINER.**

1. The expression $\sin 70^\circ$ is equivalent to

- A. $\cos 110^\circ$
- B. $2 \cos 35^\circ \sin 35^\circ$
- C. $\cos^2 35^\circ + \sin^2 35^\circ$
- D. $\cos^2 35^\circ - \sin^2 35^\circ$

2. Two airplanes take off one after the other from the same runway. When the airplanes are 2.4 km and 3.6 km respectively from the airport, the distance between them is 4.1 km. Correct to the nearest tenth of a degree, the angle between the flight paths of these airplanes is

- A. 35.6°
- B. 48.2°
- C. 60.8°
- D. 83.7°

3. In $\triangle PQR$, $\angle P = 75^\circ$ and the measures of q and r are equal. The measure of $\angle Q$ correct to the nearest tenth of a degree is

- A. 37.5°
- B. 45.0°
- C. 52.5°
- D. 75.0°

4. If $\sin A = -\frac{5}{13}$ and $\tan A < 0$, then $\sec A$ is equal to

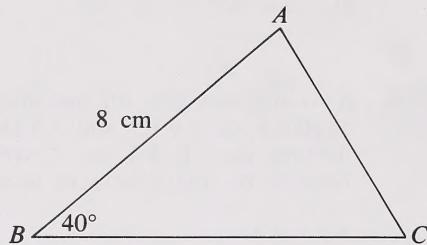
- A. $-\frac{13}{5}$
- B. $-\frac{13}{12}$
- C. $-\frac{12}{13}$
- D. $-\frac{12}{5}$

5. Correct to the nearest tenth of a radian, an angle of 105° is

- A. 1.8 rad
- B. 2.4 rad
- C. 4.0 rad
- D. 5.4 rad

6. The area of $\triangle ABC$ shown at the right is 28 cm^2 . The measure of BC correct to the nearest centimetre is

- A. 9 cm
- B. 10 cm
- C. 11 cm
- D. 12 cm



7. The definition of a unit circle implies that the circle must have

- A. a central angle measured in radians
- B. an angle in standard position
- C. a circumference of π units
- D. a radius of one unit

8. One diagonal of a parallelogram is 40 cm long. It forms angles of 70° and 50° with the adjacent sides of the parallelogram. The perimeter of this parallelogram correct to the nearest centimetre is

- A. 79 cm
- B. 142 cm
- C. 158 cm
- D. 284 cm

9. In $\triangle ABC$, $b = 15 \text{ cm}$, $c = 12 \text{ cm}$, and $\sin A = 0.9903$. If $\angle A$ is acute, then the measure of side a correct to the nearest tenth of a centimetre is

- A. 17.9 cm
- B. 18.7 cm
- C. 19.3 cm
- D. 20.5 cm

10. If $\theta \neq n\pi$, $n \in \mathbb{I}$, then $\frac{\sin \theta}{1 + \cos \theta} + \cot \theta$ is equal to

- A. $\cos \theta$
- B. $\csc \theta$
- C. $\sec \theta$
- D. $\tan \theta$

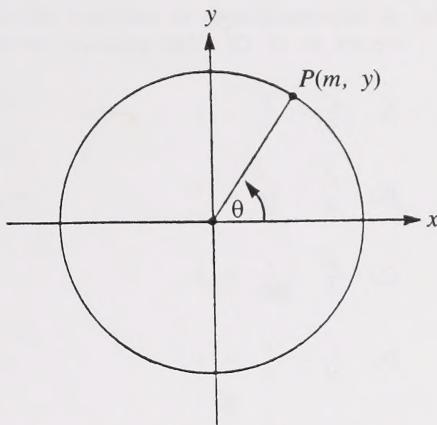
11. In the diagram at the right, θ is an angle in standard position and $P(m, y)$ is a point on the unit circle. The value of $\tan \theta$ in terms of m is

A. $\frac{m}{\sqrt{m^2 - 1}}$

B. $\frac{\sqrt{m^2 - 1}}{m}$

C. $\frac{m}{\sqrt{1 - m^2}}$

D. $\frac{\sqrt{1 - m^2}}{m}$



12. The solutions of $4 \sec^2 \theta - 16 = 0$ for $0 \leq \theta < 2\pi$ are

A. $\frac{\pi}{2}, \frac{3\pi}{2}$

B. $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

C. $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

D. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

13. If the graph of $y = \sin \theta$ undergoes a phase shift of $\frac{\pi}{2}$ radians to the right and an amplitude increase to π , then the equation of the resulting graph is

A. $y = \frac{\pi}{2} \sin(\theta + \pi)$

B. $y = \frac{\pi}{2} \sin(\theta - \pi)$

C. $y = \pi \sin\left(\theta - \frac{\pi}{2}\right)$

D. $y = \pi \sin\left(\theta + \frac{\pi}{2}\right)$

14. A hyperbola with its centre at the origin has one focus at $(-3, 0)$ and one vertex at $(2, 0)$. The equation of this hyperbola is

A. $\frac{x^2}{4} - \frac{y^2}{5} = 1$

B. $\frac{x^2}{9} - \frac{y^2}{4} = 1$

C. $\frac{y^2}{4} - \frac{x^2}{9} = 1$

D. $\frac{y^2}{9} - \frac{x^2}{5} = 1$

15. A circle is centred at $(-3, 5)$ and has a diameter of 10 units. The equation of this circle is

A. $x^2 + y^2 + 6x - 10y + 9 = 0$

B. $x^2 + y^2 + 6x - 10y - 66 = 0$

C. $x^2 + y^2 - 6x + 10y - 66 = 0$

D. $x^2 + y^2 - 6x + 10y + 9 = 0$

16. An ellipse that intersects the y -axis at $(0, \pm 11)$ has foci at $(0, \pm 5)$. The x -intercepts for this ellipse are

A. $\pm 8\sqrt{6}$

B. $\pm 6\sqrt{6}$

C. $\pm 4\sqrt{6}$

D. $\pm 2\sqrt{6}$

17. A parabola has a focus at (m, n) and a directrix of $y = 0$. The vertex of this parabola is at

A. $\left(m, \frac{n}{2}\right)$

B. $(m, 2n)$

C. $\left(\frac{m}{2}, n\right)$

D. $(2m, n)$

18. The locus of all points in a plane such that the sum of the distances from two fixed points P_1 and P_2 is a constant defines

- A. a hyperbola with vertices at P_1 and P_2
- B. a hyperbola with foci at P_1 and P_2
- C. an ellipse with vertices at P_1 and P_2
- D. an ellipse with foci at P_1 and P_2

19. The focus of the parabola $x^2 = -6y$ is at

- A. $\left(-\frac{3}{2}, 0\right)$
- B. $\left(0, -\frac{3}{2}\right)$
- C. $(6, 0)$
- D. $(0, -6)$

20. The asymptotes of the hyperbola $9x^2 - 16y^2 = 144$ are

- A. $y = \pm \frac{16}{9}x$
- B. $y = \pm \frac{4}{3}x$
- C. $y = \pm \frac{3}{4}x$
- D. $y = \pm \frac{9}{16}x$

21. The centre of the circle $2x^2 + 2y^2 - 8x + 6y - 1 = 0$ is at

- A. $\left(2, -\frac{3}{2}\right)$
- B. $\left(-2, \frac{3}{2}\right)$
- C. $(4, -3)$
- D. $(-4, 3)$

22. If the sum of the first 16 terms of an arithmetic series is 40 and the common difference is 5, then the first term of this series is

- A. -9
- B. -35
- C. -38
- D. -70

23. The sum of money invested now at 12% per annum compounded semi-annually that will amount to \$6000 in 6 years is

- A. \$3404.56
- B. \$3160.73
- C. \$3039.79
- D. \$2981.82

24. The $\lim_{n \rightarrow \infty} \left(\frac{3n^2}{2n^2 + 1} + \frac{5n}{n + 3} \right)$ is

- A. $6\frac{1}{2}$
- B. $3\frac{1}{6}$
- C. $2\frac{2}{3}$
- D. $1\frac{1}{2}$

25. If $x, \sqrt{2}, 3, y$ is a geometric sequence, then the values of x and y respectively are

- A. $\frac{2}{3}$ and $\frac{9}{\sqrt{2}}$
- B. $\frac{2}{3}$ and $\sqrt{2}$
- C. 1 and $3\sqrt{2}$
- D. $2\sqrt{2} - 3$ and $6 - \sqrt{2}$

26. If the sum of an infinite geometric series is four times the first term, then the common ratio is

A. $\frac{4}{3}$

B. $\frac{5}{4}$

C. $\frac{3}{4}$

D. $\frac{1}{4}$

27. Which of the following is a convergent sequence?

A. 8, 5, 2, -1, . . . , $(11 - 3n)$, . . .

B. -1, 1, -1, . . . , $(-1)^n$, . . .

C. $\frac{3}{2}, \frac{9}{2}, \frac{27}{2}, \dots, \left(\frac{3}{2}\right)^n$, . . .

D. 3, $\frac{1}{3}, \frac{1}{27}, \dots, (3^{3-2n})$, . . .

28. A piece of paper has the word *curriculum* printed on it. The paper is cut into 10 identical pieces, each containing one letter. If one of these slips of paper is drawn at random, the probability that the letter on that slip will be an *r* is

A. $\frac{1}{3}$

B. $\frac{1}{5}$

C. $\frac{1}{6}$

D. $\frac{1}{10}$

29. The results of a test were normally distributed with a mean of 21 and a standard deviation of 8. If the passing mark was set at 15, then the percentage of the students who passed the test was

A. 84.38%
B. 81.50%
C. 77.34%
D. 72.66%

30. A Mathematics 30 examination was written by 1250 students and the results were normally distributed. The number of students who achieved a mark within 1.5 standard deviations of the mean was

A. 1083
B. 883
C. 542
D. 442

31. A normal distribution has a mean of 25 and a standard deviation of 6. The probability that a number selected at random is less than 16 or greater than 28 is

A. 0.2417
B. 0.3753
C. 0.6247
D. 0.6826

32. In an experiment with K equally probable outcomes, there are M favorable outcomes for event A . The probability that event A will **not** occur is

A. $\frac{K - M}{A}$
B. $\frac{K - M}{K}$
C. $\frac{M - K}{A}$
D. $\frac{M - K}{K}$

Use the data in the following table to answer question 33.

Examination	Kelly's Mark	Class Mean	Standard Deviation
French	60	57	5.1
English	75	73	9.4
Chemistry	74	70	8.3
Mathematics	83	78	10.1

33. If the same number of students wrote each examination and the results are normally distributed, Kelly ranks highest in

- A. French
- B. English
- C. Chemistry
- D. Mathematics

34. The expression $(343)^{-\frac{1}{3}}$ is equal to

- A. 7
- B. 7^{-1}
- C. 7^{-3}
- D. -7

35. If $2 \log_{10}(x) + \log_{10}(y) = 3$ and $3 \log_{10}(x) - \log_{10}(y) = 7$, then x and y respectively are

- A. 10 and 10
- B. 10 and 0.1
- C. 100 and 0.1
- D. 100 and 10

36. An equivalent form of $\frac{3}{4} \log_7(x) = 5$ is

- A. $x^4 = 7^{15}$
- B. $x^3 = 5^{28}$
- C. $x^3 = 20^7$
- D. $x^3 = 7^{20}$

37. If $4 \log_3(x) = \log_5(625)$, then the value of x is

- A. 5
- B. 4
- C. 3
- D. 1

38. If $x + 2$ is a factor of the polynomial function $P(x)$, then

- A. $P(2) = 0$
- B. $P(-2) = 0$
- C. $P(x + 2) = 0$
- D. $P(x - 2) = 0$

39. If $x^4 + 2x^2 - 1$ is divided by $x + 1$, then the remainder is

- A. -4
- B. -2
- C. 0
- D. 2

40. When $ax^2 + bx + 5$ is divided by $x - 2$, the remainder is 7, and when divided by $x + 1$, the remainder is 10. The value of b is

- A. 3
- B. 2
- C. -2
- D. -3

YOU HAVE NOW COMPLETED PART A. PROCEED DIRECTLY TO PART B.

PART B

INSTRUCTIONS

In this part of the examination, there are 12 numerical-response questions each with a value of one mark. All numbers used in the questions are to be considered as **exact** numbers and are not the result of a measurement.

Read each question carefully.

Solve each question and write your answer correct to the nearest tenth.

Record your answer on the answer sheet provided by writing it in the boxes of the corresponding answer field and by filling in one circle in **every** column as illustrated.
Use an HB pencil only.

Sample Questions and Solutions

1. If θ is acute and $\sin \theta = 0.6735$, then the measure of θ correct to the nearest tenth of a degree is _____.

$$\theta = 42.33777464\dots^\circ$$

RECORD 042.3

2. For the arithmetic series $-8 + (-5) + (-2) + \dots + (85)$, the number of terms correct to the nearest tenth is _____.

$$85 = -8 + (n - 1)(3)$$

$$93 = 3n - 3$$

$$n = 32$$

RECORD 032.0

Answer Sheet

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If you wish to change an answer, erase **all** traces of your first answer.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

START PART B IMMEDIATELY.

1. If $\sin \theta = \frac{5}{13}$, $\frac{\pi}{2} < \theta < \pi$, then the value of $\csc \theta$ correct to the nearest tenth is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

2. If $1 - \cos^2 \theta = 0.9811$ and θ is acute, then the value of θ correct to the nearest tenth of a degree is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

3. The flat side of a hill forms an angle of 20° with the horizontal. When the angle of elevation of the sun is 50° , a vertical tree on this hill casts a shadow of 28 m directly down the hill. The height of this tree correct to the nearest tenth of a metre is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

4. For the ellipse $9x^2 + 4y^2 = 108$, the length of the major axis correct to the nearest tenth is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

5. The acute angle formed between the line $3x - 7y + 21 = 0$ and the x -axis correct to the nearest tenth of a degree is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

6. In an arithmetic sequence, $t_{11} = 18$ and $t_{16} = 1800$. The common difference correct to the nearest tenth is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

7. Correct to the nearest tenth, the sum of the series represented by $\sum_{k=3}^{11} (3k - 4)$ is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

8. In a school district, the midterm marks of all the Mathematics 30 students were normally distributed with a mean of 65 and a standard deviation of 15. The final marks of the same group of students were also normally distributed with a mean of 65 and a standard deviation of 15. A Mathematics 30 student in this school district had a midterm mark that translated to a z-score of -0.6 and a final mark that translated to a z-score of 0.8 . Correct to the nearest tenth, the difference between the student's final mark and midterm mark is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

9. For the values 18, 23, 23, 28, 29, 36, the median correct to the nearest tenth is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

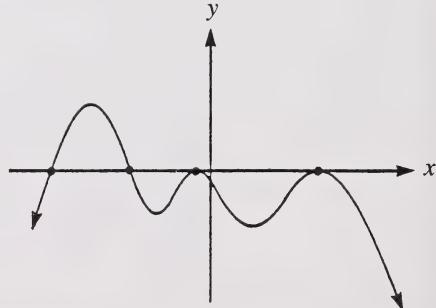
10. If $(3.5)^{2x} = 120$, then the value of x correct to the nearest tenth is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

11. Assume that the value of a painting is determined by $V = N(1.26)^{t-3}$, where V is the future value, N is the current value, and t is the time in years. If a painting is currently valued at \$270, then correct to the nearest tenth of a year, the time required for this painting to appreciate in value to \$1215 is _____.

RECORD THE ANSWER ON THE ANSWER SHEET

12. A graph of a polynomial function is sketched at the right. Correct to the nearest tenth, the minimum degree of this polynomial function is _____.



RECORD THE ANSWER ON THE ANSWER SHEET

YOU HAVE NOW COMPLETED PART B. PROCEED DIRECTLY TO PART C.

PART C

INSTRUCTIONS

In this part of the examination, there are three written-response questions for a total of 13 marks. All numbers used in the questions are to be considered as **exact** numbers and are not the result of a measurement.

Write your solutions in the examination booklet as neatly as possible.

Your solutions **must show all** pertinent explanations, calculations, and formulas. Full marks will be assigned **only** to those solutions that **show all** pertinent explanations, calculations, and formulas.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work. **No marks** will be given for work done on the tear-out pages.

START PART C IMMEDIATELY.

(4 marks)

1. The graph of $y = x^3 + 5x^2 + cx - 8$ has an x -intercept of 1. Find the remaining x -intercepts for the graph of this function. Show the method you used to determine these intercepts.

The remaining x -intercepts are

2. The first and second terms of a sequence are a and b respectively.

One student, assuming that the sequence is arithmetic, determines that the common difference is $\frac{16}{5}$. Another student, assuming that the sequence is geometric, determines that the common ratio is $-\frac{3}{5}$.

a. If the sequence is arithmetic, express b in terms of a .

$$b = \underline{\hspace{2cm}}$$

b. If the sequence is geometric, express b in terms of a .

$$b = \underline{\hspace{2cm}}$$

c. Find the values for a and b that would be consistent with the assumptions of both students.

$$a = \underline{\hspace{2cm}}, b = \underline{\hspace{2cm}}$$

(4 marks)

3. a. A circle with its centre at $(-4, 0)$ has a radius of 5.
Determine the equation for this circle.

The equation for this circle is

b. A parabola with its vertex at the origin has its focus at $(-2, 0)$.
Determine the equation for this parabola.

The equation for this parabola is

c. The circle and parabola described above intersect at two points. Find the value of x at these points.

The value of x at these points is

**YOU HAVE NOW COMPLETED THE EXAMINATION. IF YOU HAVE TIME,
YOU MAY WISH TO GO BACK AND CHECK YOUR ANSWERS.**

MATHEMATICS 30

FORMULA SHEET

FOLD AND TEAR ALONG PERFORATION

I. Trigonometry

1. $\pi = 3.14159$
2. $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
3. $a^2 = b^2 + c^2 - 2bc \cos A$
4. $\sin^2 A + \cos^2 A = 1$
5. $1 + \tan^2 A = \sec^2 A$
6. $1 + \cot^2 A = \csc^2 A$
7. $\sin\left(\frac{\pi}{2} - \theta\right) = \cos \theta$
8. $\cos\left(\frac{\pi}{2} - \theta\right) = \sin \theta$
9. $\sin(A + B) = \sin A \cos B + \cos A \sin B$
10. $\sin(A - B) = \sin A \cos B - \cos A \sin B$
11. $\cos(A + B) = \cos A \cos B - \sin A \sin B$
12. $\cos(A - B) = \cos A \cos B + \sin A \sin B$
13. $\sin(-\theta) = -\sin \theta$
14. $\cos(-\theta) = \cos \theta$
15. $\tan(-\theta) = -\tan \theta$

II. Quadratic Relations

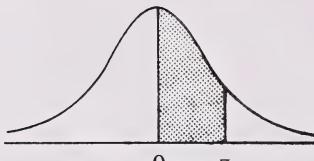
1. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
2. $d = \frac{|Ax_1 + By_1 + C|}{\sqrt{A^2 + B^2}}$
3. $M\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$
4. $(x - h)^2 + (y - k)^2 = r^2$
5. $x^2 + y^2 + Dx + Ey + F = 0$
6. $(y - k)^2 = 4p(x - h)$
7. $(x - h)^2 = 4p(y - k)$
8. $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, a^2 = b^2 + c^2$
9. $\frac{y^2}{a^2} + \frac{x^2}{b^2} = 1, a^2 = b^2 + c^2$
10. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1, c^2 = a^2 + b^2$
11. $\frac{y^2}{a^2} - \frac{x^2}{b^2} = 1, c^2 = a^2 + b^2$

III. Sequences, Series, and Limits

1. $t_n = a + (n - 1)d$
2. $S_n = \frac{n(a + t_n)}{2}$
3. $S_n = \frac{n[2a + (n - 1)d]}{2}$
4. $A = P(1 + i)^n$
5. $t_n = ar^{n-1}$
6. $S_n = \frac{a(r^n - 1)}{r - 1}$
7. $S_n = \frac{rt_n - a}{r - 1}$
8. $S = \frac{a}{1 - r}, -1 < r < 1$

IV. Statistics

1. $\mu = \frac{x_1 + x_2 + \dots + x_n}{n}$
2. $\sigma = \sqrt{\frac{(x_1 - \mu)^2 + \dots + (x_n - \mu)^2}{n}}$
3. $z = \frac{x - \mu}{\sigma}$

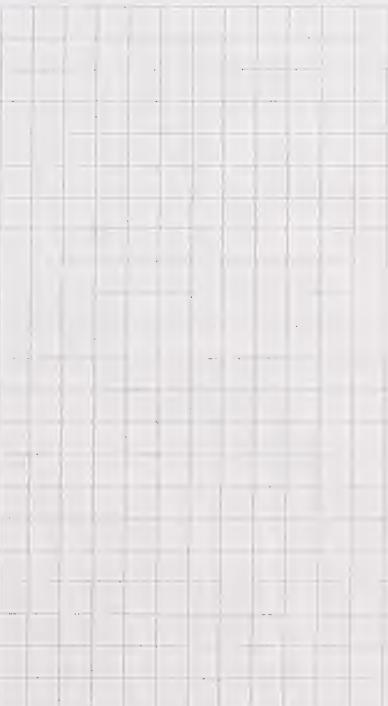
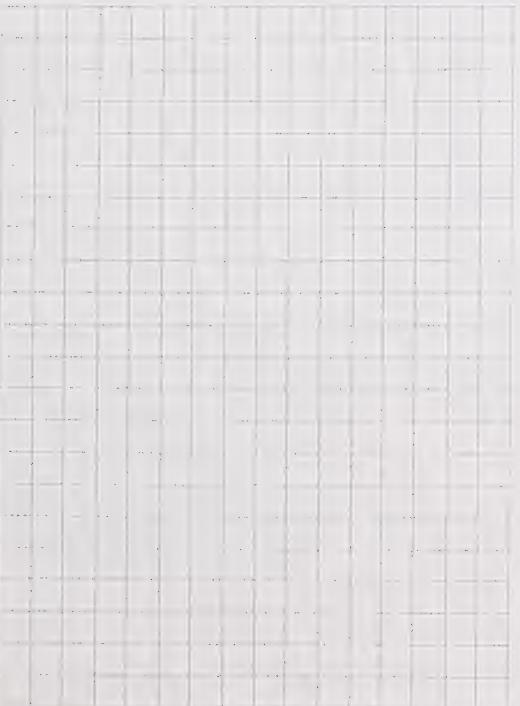
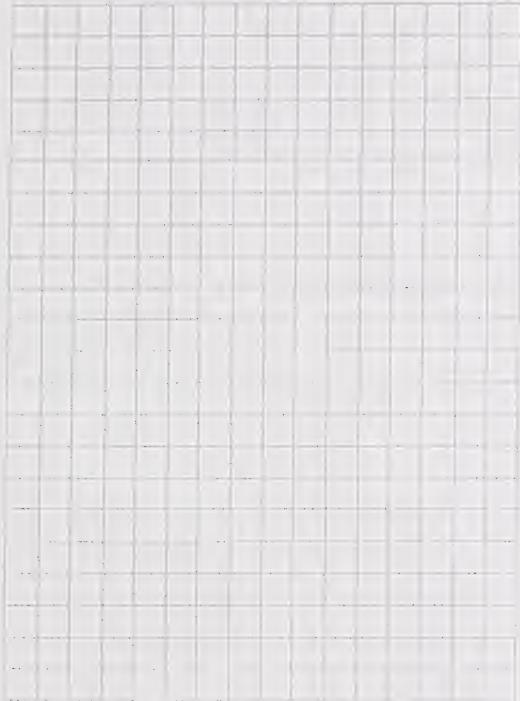


AREAS UNDER THE STANDARD NORMAL CURVE

FOLD AND TEAR ALONG PERFORATION

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FOR DEPARTMENT USE ONLY

M1	<input type="checkbox"/>
M2	<input type="checkbox"/>
M3	<input type="checkbox"/>
M4	<input type="checkbox"/>

APPLY LABEL WITHOUT STUDENT'S NAME

MATHEMATICS 30

(LAST NAME)	<input type="text"/>	Y	M	D
NAME:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
PERMANENT MAILING ADDRESS:	(Apt./Street/Ave./P.O. Box)			
SCHOOL CODE:	<input type="text"/>	SCHOOL:	(Village/Town/City)	
SIGNATURE:	(Postal Code)			

APPLY LABEL WITH STUDENT'S NAME